

HIRAY PLUS X-RAY MACHINE

USER MANUAL



Art. No. 701115

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1. DESCRIPTION

HiRay PLUS is the most advanced portable x-ray unit available both for the field and clinic application.

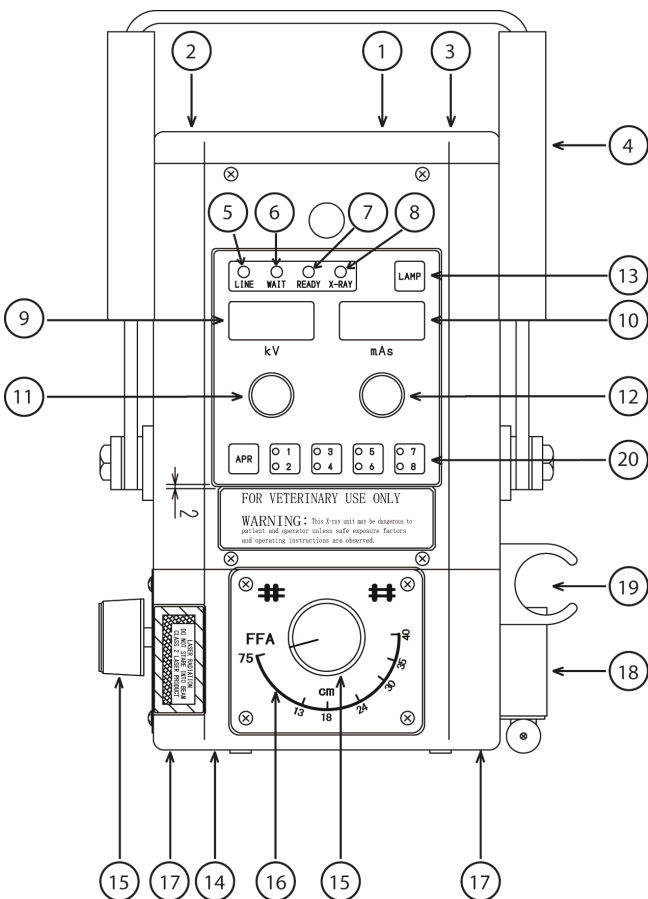
The built-in collimator with 2 crossing lines and 2 laser pointers confirms an easy and quick acquirement of each radiographic position, limiting the need for remarks.

By means of the automatic mAs control technique, the real kV selected on the panel is always maintained even at the place where the line voltage is dropped by high impedance in order to obtain the expected firm result.

HiRay PLUS is the mono block type, including

- Generator (includes x-ray tube in the H.T. transformer with 2 kW inverter)
- Built-in collimator and 2 laser pointers
- Line cable
- Hand switch with curled cable
- Heavy duty carrying case

2. PANEL GUIDE



1. Line switch (breaker)
2. Socket for plug of line cable
3. Socket for plug of hand switch cable
4. Handle
5. Line lamp (green)
6. Wait / alarm lamp (red)
7. Ready lamp (green)
8. X-ray lamp (amber)
9. kV display window
10. mAs display window
11. kV selector
12. mAs selector
13. Collimator lamp switch
14. Collimator
15. X-ray field adjustment knob
16. X-ray field indicator
17. Laser pointer
18. Scale
19. Hand switch in holder
20. APR switches

3. OPERATION

Assembly

Unpack the unit and inspect it for any damage. Extend the cable out to their fullest length. Pay careful attention to the cables and inspect them for worm or broken insulation. If they show signs of undue wear, do not plug the unit in or attempt to use it. Connect a plug of the hand switch cable to the socket for a plug of the hand switch cable [3].

Then connect a plug of the line cable to the socket for a plug of the line cable [2] and the other plug to the power source, confirming the line switch [1] is at "OFF" position.

Before making the Exposure

At the first installation or when the unit is used after 2 weeks or more absence from its last use, a warming up procedure of the x-ray tube is necessary to ensure the longevity of the x-ray tube (tube aging)

A recommended warming up procedure is as below:

(1) Sufficient radiation protection should be taken.

(2) Make the following exposures at 15 seconds intervals.

1st: 5 exposures at 50 kV/5,0 mAs

2nd: 5 exposures at 70 kV/5,0 mAs

3rd: 5 exposures at 100 kV/5,0 mAs

Once this aging procedure is performed, it is not required from next time.

So the unit is ready for immediate exposure unless it is not in use for more than 2 weeks.

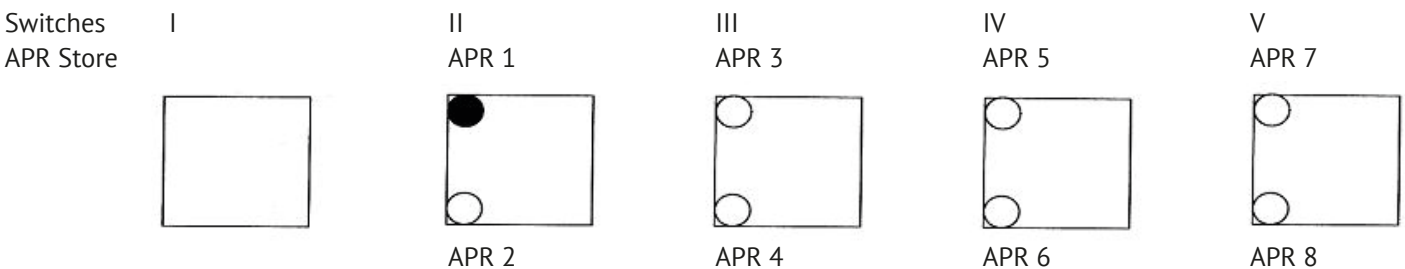
Operation

Turn the line switch [1] to "ON" position and confirm the kV display [9] and mAs display [10] are lighted.

Select proper technique for the exposure, using the kV selector [11] and mAs selector [12].

In case the APR technique is desired to use:

How to store the Examination Parts and Exposure Data



When either switch of II, III, IV or V is pressed, the upper lamp lights. The upper lamp of the switch II represents APR1. The upper lamp of the switch III represents APR3, the upper lamp of the switch IV for APR5 and the upper lamp of the switch V for APR7.

If these switches are pressed again, the lower lamp of the switch lights. The lower lamp of switch II represents APR 2, the lower lamp of switch III APR 4, the lower lamp of switch IV APR6 and the lower lamp of switch V APR8.

After the lamp of the desired APR switch is lighted, select the kV and mAs in the display windows [9] and [10] by the rotary selector [11] and [12] for each exam part.

Then press the switch I for "APR STORE" to store each exam. Part and its corresponding exposure data.

Immediately after releasing "APR STORE" switch, the buzzer informs the completion of the store of the parts and data.

By continuation of these steps, the data up to 8 exam. Parts are stored.

How to select the stored Data and Parts and make an Exposure

For this purpose, it is recommended to write the examination part of each APR switch (APR 1–APR8) on the panel or somewhere to remember.

Press the desired APR switch. Then the lamp on the switch lights.

Stored exposure data of its corresponding examination part appears on the display window for confirmation and the system is ready for the exposure.

By pressing the collimator lamp switch [13], the halogen lamp is lighted.

Illuminated area is adjusted by turning two x-ray field adjustment knobs [15]. The center of the x-ray field is obtained by two crossing lines.

Two laser pointers [17] are also lighted. Thus the crossing point (the distance between two beams at the crossing point is within 5 mm) of these laser beam makes it possible to obtain quick and easy confirmation of 75 cm \pm 2 cm SID and almost the center of a radiographic field (which is considered to be within the range of 1.5 cm from actual center of the crossing point of the collimator) at 75 cm of SID even under the sunlight.

Those lights are extinguished automatically after 30 seconds in order to save the life of bulbs.

To make an exposure, press the hand switch half way down. During 1.5 seconds after this first press, the filament of the tube is heated and the ready lamp lights.

Then depress the hand switch fully down and the x-ray lamp lights, confirming the exposure.

The duration of the exposure is signaled by the x-ray lamp and audible buzzer sounds at the end of the exposure.

After the exposure, the wait lamp is flickering and next exposure is ready when this flickering is extinguished.

This wait lamp also works as the alarm lamp and the lamp is lighted continuously in case any trouble happens in the circuit.



Note!

1. The exposure is managed by two step depression as stated above. However full depression at one time is also accepted. In this case, the exposure is obtained after 1.5 seconds from the full depression.
2. The exposure button of the hand switch should be depressed until the exposure is fully completed.
3. The exposure can be terminated at any time by releasing the exposure button. The mAs display blinks. To return operation, press "LAMP" button.
4. The unit must have a certain waiting period until next exposure in order to protect the system from a damage by an overheat which would be caused by continuous exposures.

< WAIT TIME >

When the kV setting is made at the value between 40 kV and 66 kV;

- the wait time will be between **0,3 and 5 seconds**, depending on the exposure time, at the mAs selection between 0,3 and 5 mAs.
- the wait time will be **6 seconds** at the mAs selection exceeding 6,4 mAs.

When the kV setting is made at the value exceeding 68 kV;

- the wait time will be between **0,45 and 4,8 seconds**, depending on the exposure time, at the mAs selection between 0,3 and 3,2 mAs.
- the wait time will be **6 seconds** at the mAs selection exceeding 4 mAs.

5. The LEVEL (WATER SCALE) [21] is attached for horizontal adjustment.

6. The digital (kV-mAs) display Fascia direction can be changed.

How to change Direction of the kV-mAs Display

- A main powering switch is turned off.
- Push the APR store switch.
- A main powering switch is turned on.
- Keep pushing the APR store switch for more than three seconds at a time.
- The display direction of only digits (kV-mAs) can be changed to the contrary direction. N.B. When you order, please specify the fascia direction, so that your ordered unit can be made at the factory according to your fascia direction,
- The display direction00 is stored, when the power supply is turned off.



Caution!

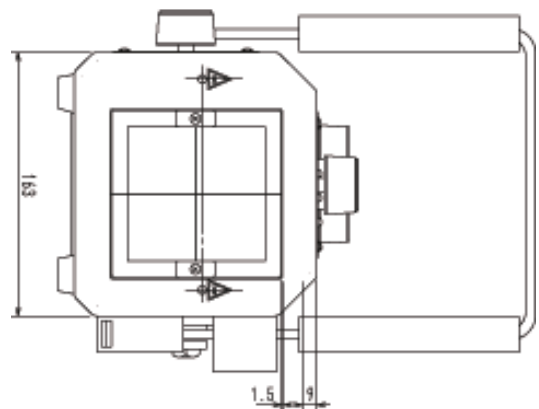
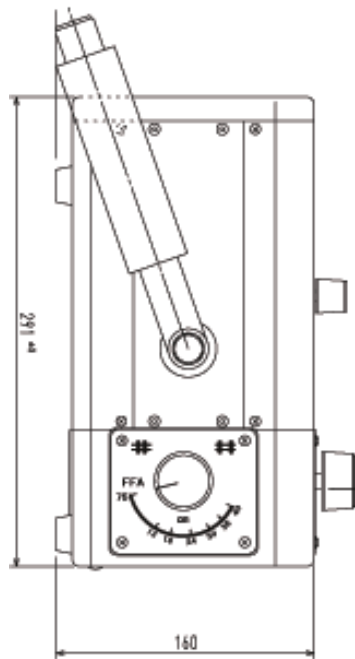
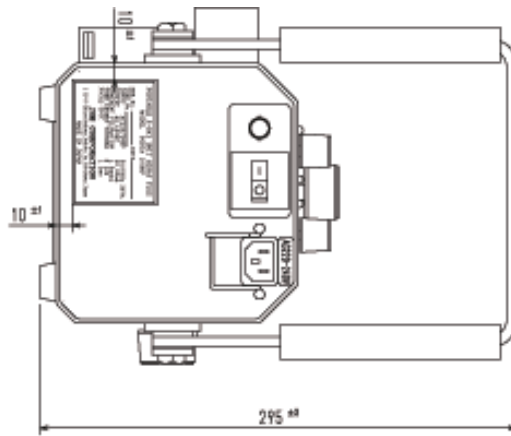
Do not place the laser pointer for direct eye exposure since the laser beam is dangerous to the eyes.

4. SPECIFICATIONS

System Composition:	X-ray control with generator (tube & H.T. transformer) Collimator with 2 laser pointers Power cable (6 meter long) Hand switch with curled cable (2.5 meter long at full extension)
Performance specifications:	Output: max. 2 kW (100 kV, 20 mA / 66 kV, 30 mA) kV output: 40–100 kV Stability: ± 2 % kV rising up time: within 2 msec (Until becoming up to 75% of set kV)
kV setting:	40–100 kV (2 kV step)
mAs selection:	0.3–20 mAs (32 settings): 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 2.0, 2.2, 2.5, 2.8, 3.2, 4.0, 5.0, 6.4, 7.0, 8.0, 9.0, 10, 12, 16, 20 mAs
Max. deviation:	kV: ± 4 % mA: ± 7 % mAs: ± 15 % (0.3–16 mAs), ± 20 % (20 mAs and over)
X-ray tube:	Toshiba D-124 Focal spot: 1.2 x 1.2 mm Heat unit: 20 kHU Target angle: 16 degrees
Total filtration:	2.5 mm AL. eq. at 100 kV
Collimator:	Single plane, double slit type Manually operated Complete with 30 sec timer, cross indication lines and halogen lamp. Also 2 laser pointers are provided for easy confirmation of the center of a radiographic field and the SID of 75 cm even under the sunlight.
Power cable:	6 m long
Hand switch:	Two stage, deadman type with curled cable (2.5 meter long at full extension)

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Power requirement:	200–240 V
Power capacity:	220 V, 20 A
Opt. ambient conditions:	Temperature: 20 °C ±15 °C Humidity: 69 % ±20 %
Net weight:	X-ray unit: 8.8 kg Carrying case: 4 kg
Dimensions:	See drawings



5. EXPOSURE SCHEDULE

6.1 Without Grid

Thickness in cm	Up to 5		Up to 10		Up to 15		Up to 20		Up to 25		Up to 30		Up to 35	
	kV	mAs	kV	mAs	kV	mAs	kV	mAs	kV	mAs	kV	mAs	kV	mAs
Abdomen l-l	50-54	1,0-1,4	52-56	1,6-1,8	52-54	2,0-2,5	54-56	2,5-3,2	54-58	3,2-4,0	58-60	4,0-5,0	58-60	5,0-6,4
Spinal Column l-l	54-58	0,8-1,2	58-60	1,6-1,8	62-64	1,8-2,5	64-66	2,5-3,2	68-72	3,2-4,0	74-78	4,0-5,0	76-78	5,0-6,4
Pelvis/HD v-d			62-64	2,0-2,5	64-66	3,2-4,0	66-68	4,0-5,0	68-70	4,0-5,0	70-72	5,0-6,4	72-74	5,0-6,4
Thorax l-l	56	0,5	56-60	0,8-1,0	60-64	1,2-1,6	68-72	1,2-1,6	76-80	1,6-1,8	80-86	1,8-2,0	90-94	2,0-2,5
Extremities	50-54	0,5-0,8	54-58	1,0-1,6										

6.2 With Grid

Thickness in cm	Up to 5		Up to 10		Up to 15		Up to 20		Up to 25		Up to 30		Up to 35	
	kV	mAs	kV	mAs	kV	mAs	kV	mAs	kV	mAs	kV	mAs	kV	mAs
Abdomen l-l	50-54	1,5-2,1	52-56	2,4-2,7	52-54	3,0-3,7	54-56	3,7-4,8	54-58	4,8-6,0	58-60	6,0-7,5	58-60	7,5-9,6
Spinal Column l-l	54-58	1,2-1,8	58-60	2,4-2,7	62-64	2,7-3,7	64-66	3,7-4,8	68-72	4,8-6,0	74-78	6,0-7,5	76-78	7,5-9,6
Pelvis/HD v-d			62-64	3,0-3,7	64-66	4,8-6,0	66-68	6,0-7,5	68-70	6,0-7,5	70-72	7,5-9,6	72-74	7,5-9,6
Thorax l-l	56	1,0	56-60	1,2-1,5	60-64	1,8-2,4	68-72	1,8-2,4	76-80	2,4-2,7	80-86	2,7-3,0	90-94	3,0-3,8
Extremities	50-54	1,0-1,2	54-58	1,5-2,4										

Thickness means the amount of tissue in the center of x-ray. It should be measured correctly in order to find out the right technique. The recommendation depends on the nutritional status of the patient.

A scattered grid should be used with a thickness of more than 10 cm.

The values given here are exposure recommendations for a film focus distance of 75 cm.

Film system used: green-emitting SC 400



Notes!

You might have to correct the values given in the exposure schedule depending on the film intensifier screen system used or when used with digital systems.

For obese animals, the upper range values apply. Very slim animals should be X-rayed with the lower values. Grease is a very good contrast medium and should usually appear light gray, while soft tissue appears dark gray. Fluid accumulations and bones appear relatively bright on the radiograph.

NOTES

NOTES

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